N_o = total noise power in audio system

B = audio system bandwidth assumed flat to B and zero beyond.

The S/N power ratio is

$$(S_o/N_o)\ fm = \frac{m^2/2 \cdot 4\pi^2 F^2}{4/3\,\pi^2 m^2 n/P_c\, B^3} \tag{9}$$

$$= \frac{3}{2}\left[\frac{F}{B}\right]^2 \frac{1}{B} \cdot \frac{P_c}{n}$$

If the audio passband is equipped with a deemphasis filter which reduces the noise output in the ratio

$$P_o/P_{in} = \frac{1}{1 + f^2/f_o^2} \tag{10}$$

, simple RC filter only

P_o = power output of the deemphasis filter

P_{in} = power input to the filter

f = instantaneous frequency in passband B

f_o = frequency at which RC network is down 3 Db or turnover frequency

The noise output is

$$N_d = \int_{-B}^{B} \frac{d(N_o)}{1 + f^2/f_o^2}\, df = \frac{4\pi^2 m^2 n}{P_c} \int_0^B \frac{f^2}{1+f^2/f_o^2}\, df \tag{11}$$

$$= \frac{4\pi^2 m^2 n}{P_c}\left[B f_o^2 - f_o^3 \tan^{-1} B/f_o\right]$$

N_d = audio noise output with deemphasis filter

The audio S/N power ratio is given by

$$S_o/N_d = \frac{\frac{m^2}{2} 4\pi^2 \cdot F^2}{\frac{4\pi^2 m^2 n}{P_c}\left[B f_o^2 - f_o^3 \tan^{-1} B/f_o\right]} \tag{12}$$

$$= \frac{F^2}{2\left[B f_o^2 - f_o^3 \tan^{-1} B/f_o\right]} \cdot \frac{P_c}{n}$$

The improvement factor due to the deemphasis filter is

$$\frac{S_o/N_d}{S_o/N_o} = \frac{B^3}{3\left[B f_o^2 - f_o^3 \tan^{-1} B/f_o\right]} \tag{13}$$

For a 75 u sec deemphasis circuit, $f_o = 2.125 \times 10^3$ and $\tan^{-1} B/f_o = 1.43$ when B = 15,000. The deemphasis improvement is 13.2 Db.

Subcarrier Multiplex Operation

If the carrier is modulated by a single subcarrier frequency such that

$$M(t) = A_o \sin(W_c t + F/f_s \sin W_s t) \tag{14}$$

f_s = subcarrier frequency, the output voltage is given by

$e_{sc} = m \cos\omega_s t$, and $P_{sc} = \frac{m^2 4\pi F}{2}$

e_{sc} = subcarrier voltage at discriminator

P_{sc} = subcarrier power at discriminator

If the subcarrier signal is passed through a bandpass filter having a low frequency cut off B_1 and an upper frequency cut off B_2, the noise output is given by

$$N_{sp} = \frac{m^2 2\pi^2 n}{P_c}\left[\int_{-B_2}^{-B_1} f^2\, df + \int_{B_1}^{B_2} f^2\, df\right] \tag{15}$$

$$= \frac{4\pi^2 m^2 n}{3 P_c}\left(B_2^3 - B_1^3\right)$$

B_2 = upper bandpass cuttoff frequency

B_1 = lower bandpass cuttoff frequency

The filter is assumed ideal and rectangular in passband shape. The S/N power ratio at the output of the Multiplex bandpass filter is

$$\frac{P_{sc}}{N_{sp}} = \frac{3F^2 P_c}{2n(B_2^3 - B_1^3)} \tag{16}$$

Now if F is taken to be the maximum allowable frequency deviation in the transmitted signal, and the subcarrier uses a portion P_1 of this deviation, the signal power is reduced by P_1^2, and the S/N ratio becomes

$$\frac{P_{sc}'}{N_{sp}} = \frac{3 p_1^2 F^2 P_c}{2n(B_2^3 - B_1^3)} \tag{17}$$

p_1 = the portion of the total deviation used for the subcarrier. If the subcarrier f_s is located midway between B_1 and B_2, such that $B_2 = f_s + B_a$ and $B_1 = f_s - B_a$, where B_a is maximum modulating frequency, then $(B_2^3 - B_1^3) = 6 f_s^2 B_a + 2 B_a^3$, and

$$\frac{P_{sc}}{N_{sc}} = \frac{3 p_1^2 F^2}{4(3 f_s^2 B_a + B_a^3)} \cdot \frac{P_c}{m} \tag{18}$$

An approximate form of this equation can be derived by assuming the noise power in the passband is constant as a function of frequency rather than parabolic.

If the power is assumed constant with frequency at a level determined by the center of the passband or subcarrier frequency,

$$dN_m = \frac{2\pi^2 m^2 n f_s^2}{P_c} df, \tag{19}$$

$$N_{sc}' = \frac{2\pi^2 m^2 n f_s^2}{P_c}\left[\int_{-B_2}^{-B_1} df + \int_{B_1}^{B_2} df\right] \tag{20}$$

$$N_{sc}' = \frac{8\pi^2 m^2 n}{P_c} f_s^2 B_a \tag{21}$$

N_{BP}' = approximate bandpass noise,

and
$$N_{sc} = \frac{8\pi^2 m^2 n}{P_c}\left(3 f_s^2 B_a + B_a^3\right); \tag{22}$$

the B_a^3 term represents the parabolic correction term. The maximum error introduced by neglecting B_a^3 can be observed by assuming certain limiting characteristics.. When the subcarrier f_s which is modulated by B_a has a lower sideband extending to $f_s - B_a$, and the main channel is modulated by signal frequencies extending to B_m, f_s is equal to or greater than 2 B_m. When this is the case, the parabolic correction term provides less than 1 db of correction and the rectangular spectrum can be assumed with negligible error.

Considering the case where the subcarrier is amplitude modulated, the signal output of the bandpass filter is

$$e_f = m p_1 F \pi \left[(1 + K V(t))\right] \sin(\omega_{sc} t + \phi), \tag{22}$$

where K = Modulation factor

V(t) = audio modulation for subcarrier

e_f = bandpass output voltage

ϕ = subcarrier phase at t = 0;

W_{sc} = subcarrier angular velocity

If suppressed carrier modulation is used

$$e_f = m p_1 2\pi F K V(t) \cos(\omega_{sc} t + \phi) \tag{23}$$

whose peak value is $2\pi m p_1 F = \hat{e}_f$,
and $P_f = 2\pi^2 m^2 p_1^2 F^2$

P_f = peak signal power derived from subcarrier detector obtained by restoring the carrier and detecting the envelope voltage. The envelope voltage is taken to be $e_v = m p_1 2\pi F K V(t)$;

e_v = the envelope signal voltage.

The detector noise from the bandpass filter can be obtained by summing the noise which beats with the restored carrier:

$$N_d = \frac{2\pi^2 m^2 n f_s^2}{P_c}\left[\int_{-B_a}^{+B_a} df + \int_{f_s - B_a}^{f_s + B_a} df\right] \tag{24}$$

$$= \frac{8\pi^2 m^2 n f_s^2}{P_c} B_a$$

The signal to noise power ratio at the subcarrier detector is

$$\frac{P_f}{N_d} = \frac{p_1^2 F^2}{4 f_s^2 B_a} \cdot \frac{P_c}{n} \tag{25}$$

For the case where F = 75 kcps,

$$\frac{P_f}{N_d} = \frac{1.4 \times 10^9 p_1^2}{f_s^2 B_a} \cdot \frac{P_c}{n} \tag{26}$$

When the subcarrier signal is passed through a deemphasis filter, the subcarrier audio noise is reduced by

$$\frac{P_o}{P_{in}} = \frac{1}{1 + \frac{f^2}{f_1^2}} \quad \begin{Bmatrix}\text{single}\\ \text{RC}\\ \text{filter}\end{Bmatrix} \tag{27}$$

Where P_o = deemphasis power output

P_{in} = deemphasis power input

B_a = max. audio in subcarrier channel

B_o = 3 db cuttoff frequency of simple RC filter

f = instantaneous audio frequency in the subcarrier channel

The subcarrier audio incremental noise becomes

$$dN' = \frac{2\pi^2 m^2 n f_a^2}{P_c} \cdot \frac{1}{1 + \frac{B_a^2}{B_o^2}} \qquad (28)$$

and the total subcarrier noise is

$$N_d' = \frac{8\pi^2 m^2 n f_a^2}{P_c} \int_0^{B_a} \frac{1}{1 + \frac{f^2}{B_o^2}} df \qquad (29)$$

$$= \frac{8\pi^2 m^2 n f_a^2}{P_c} B_o \tan^{-1} \frac{B_a}{B_o}$$

being the total subcarrier noise with deemphasis.

The noise reduction produced by deemphasis network in the subcarrier is given by (30)

$$\frac{N_d}{N_d'} = \frac{B_a}{B_o \tan^{-1} B_a/B_o}$$

When B_o = 2.125 kcps, B_a = 15 kcps, the noise reduction is 6.8 db in the subcarrier deemphasis, while on the main channel a similar network produced a 13.2 db noise reduction. The difference is caused by the triangular noise voltage spectrum present in the main channel; however, since the subcarrier is suppressed carrier AM, the noise spectrum is rectangular, and the deemphasis is less effective in reducing noise. The Signal to Noise power ratio in the subcarrier channel is

$$\frac{P_s}{N_d'} = \frac{P_c}{n} \cdot \frac{p^2 F^2}{4 f_a^2 B_o \tan^{-1} \frac{B_a}{B_o}} \qquad (31)$$

Again, where F = 75 kcps, (32)

$$\frac{P_s}{N_d'} = \frac{1.4 \times 10^9 p^2}{f_a^2 B_o \tan^{-1} \frac{B_a}{B_o}}$$

In practice the multiplex channel used for stereo operation, and the main channel contains the sum of two stereo channels while the subcarrier contains the difference as given by:

$e_l + e_r$ = main channel output voltage and

$e_l - e_r$ = subcarrier channel output voltage.

In order to recover e_l and e_r, the main and sub channels can be added resistively to provide

$$\frac{\begin{matrix} e_l + e_r \\ e_l - e_r \end{matrix}}{2e_l} \quad \text{or} \quad \frac{\begin{matrix} e_l + e_r \\ -e_l + e_r \end{matrix}}{2e_r}$$

where e_l is the signal voltage for the left channel and e_r is the signal voltage for the right channel.

From this it can be seen that when

$$\hat{e}_l = \hat{e}_r, \quad \hat{e}_l - \hat{e}_r = 0$$

$$2\hat{e}_l = \text{peak left channel voltage}$$

$$2\hat{e}_r = \text{peak right channel voltage}$$

Using $e_l - e_r$ to modulate the suppressed subcarrier channel, when $\hat{e}_l = \hat{e}_r$ the subcarrier is zero. Letting

$$p_2 \hat{e}_l + p_3 \hat{e}_r + p_1 \hat{e}_\pi = e_m \qquad (33)$$

$$(p_2 + p_3 + p_1 = 1);$$

where

$\hat{e}_\pi$ = peak pilot carrier voltage, and

e_m = maximum signal that could appear at the output for a monophonic signal. If p_1 = .1 and $p_2 = p_3$ = .45 (max. value), then $2\hat{e}_l$ = .9e_m and $2\hat{e}_r$ = .9e_m, then $P_{cl} = 4p_2^2 \; P_{cm}$, and P_{cr} = $4p_3^2 \; P_{cm}$. P_{cl} and P_{cr} are max. power available from stereo output, and P_{om} is peak monophonic power available. Thus, the stereo signal to noise ratio is

$$\frac{P_{cl}}{N_a} = \qquad (34)$$

$$\frac{P_c}{n} \cdot \frac{4 p_2^2 P_{cm}}{\left[8\pi^2 m^2 f_a^2 B_o \tan^{-1} \frac{B_a}{B_o} + 4\pi^2 m^2 \left(B f_a^2 - f_o^2 \tan^{-1} \frac{B}{f_o}\right)\right]}$$

$$\frac{P_{oL}}{N_s} = \frac{P_c}{n}\cdot\frac{4p_s^2 m^2 2\pi^2 F^2}{\left[8\pi^2 m^2 f_s^2 B_o \tan^{-1}\frac{B_s}{B_o} + 4\pi^2 m^2 \left(Bf_o^2 - f_o^3 \tan^{-1}\frac{B}{f_o}\right)\right]} \quad (35)$$

$$\frac{P_{oL}}{N_s} = \frac{P_c}{n}\cdot\frac{2p_s^2 F^2}{\left[2f_s^2 B_o \tan^{-1}\frac{B_s}{B_o} + Bf_o^2 - f_o^3 \tan^{-1}\frac{B}{f_o}\right]} \quad (36)$$

N_s = stereo noise power in the left or right channel. The stereo signal to noise power ratio to monophonic signal to noise power ratio gives the loss in S/N ratio when multiplex stereo is added.

$$\left(P_{om} = S_o = m^2 2\pi^2 F^2\right)$$

$$\frac{P_{om}/N_m}{P_{oL}/N_s} = \frac{\frac{P_c}{n}\cdot\frac{F^2}{2\left[2Bf_o^2 - f_o^3 \tan^{-1} B/f_o\right]}}{\frac{P_c}{n}\cdot\frac{2p_s^2 F^2}{2\left[f_s^2 B_o \tan^{-1}\frac{B_s}{B_o} + Bf_o^2 - f_o^3 \tan^{-1}\frac{B}{f_o}\right]}} \quad (37)$$

$$= \frac{2f_s^2 B_o \tan^{-1}\frac{B_s}{B_o}}{4p_s^2\left[Bf_o^2 - f_o^3 \tan^{-1}\frac{B}{f_o}\right]} + \frac{1}{4p_s^2}$$

Using the conditions:

$B = B_s = 15$kcps

$B_o = f_o = 2.125$kcps

$f_s = 38$kcps

$p_s \approx .45$

the stereo S/N loss is 23Db.

This figure is the same when either the main or the subcarrier channel is carrying full modulation, and the same condition exists for identical modulation on the main and subcarrier channel. From the preceding notes and calculations it should be observed that the signal to noise ratio is attenuated by three major factors when detecting an FM multiplex signal. Specifically, these are the effect of noise triangulation, the restricted amount of carrier deviation, and the resultant effect of deemphasis.

REFERENCE:

1. Modulation Theory

By: Harold S. Black,
Bell Telephone Laboratories, Inc.

IEEE Transactions

on BROADCAST AND TELEVISION RECEIVERS

CHICAGO SPRING CONFERENCE ISSUE

Volume BTR-9 JULY, 1963 Number 2

TABLE OF CONTENTS

PROFESSIONAL TECHNICAL GROUP ON
BROADCAST AND TELEVISION RECEIVERS

THE STUDY OF SCA INTERFERENCE IN STEREO FM RECEIVERS

Don J. Popp
Zenith Radio Corporation
Chicago, Illinois

Summary

The FM Stereo Broadcast System as adopted by the FCC two years ago included the accommodation for the transmission of an SCA background channel service on the RF carrier along with the two stereo channels. This simultaneous transmission of a third channel with the stereo program can result in an intermodulation interference in improperly designed or aligned stereo FM receivers.

In evaluating SCA interference, this paper shall consider:

1. The nature of SCA interference;

2. Possible sources of the interference in a stereo FM receiver;

3. Results of the testing of a cross-section of the stereo FM receiver market; and

4. Methods of minimizing the interference.

Introduction

Approximately 250 FM radio stations across the country are now broadcasting in Stereo FM. A recent tabulation indicates that 92 of these are authorized for SCA background channel operations.

Following is a summary of Engineering Standards for Subsidiary Communications Multiplex Operations for stereophonic broadcasting as contained in the Report and Order of Docket #13506 issued by the Federal Communications Commission in 1961.

1. Frequency Modulation of SCA subcarriers shall be used.

2. Instantaneous frequency of SCA subcarriers shall at all times be within the range of 53 KC to 75 KC.

3. The modulation of the main carrier by the SCA subcarrier shall not exceed 10 per cent.

It is current practice for broadcasters who are programming both in the stereo and the SCA channels to select 67 KC as the SCA subcarrier frequency. This subcarrier is then frequency modulated by the SCA program with a frequency deviation of ± 6 KC being common. These parameters shall be used for the purposes of this evaluation.

Figure 1 shows the frequency spectrum of the composite stereo modulation with an SCA channel. This composite modulation can be expressed as follows:

$$(1)\quad M = (L+R) + (L-R)\cos \omega t + X\cos\frac{\omega t}{2} + Q\cos B(t)$$

where: L = left channel modulation
R = right channel modulation
ω = stereophonic subcarrier angular frequency
X and Q = modulation constants
$\cos B(t)$ = frequency modulated SCA channel
$B(t) = (bt + \frac{M}{a}\cos at)$

where: b = SCA subcarrier angular frequency
M = Frequency deviation
a = SCA audio angular frequency

It can be recalled from the FCC Rules on Stereophonic Broadcasting that the (L+R) MAIN channel and the (L-R) 38 KC SUBCARRIER channel both frequency modulate the main radiated carrier 80 per cent. The 19 KC PILOT subcarrier modulates the radiated carrier 10 per cent which leaves the remaining 10 per cent of the main carrier modulation for the addition of the SCA channel subcarrier. As can be seen from Figure 1, the opportunity for intermodulation exists between the various components of the stereo modulation, should this modulation be passed through non-linear circuits either in the transmitter or in a stereo receiver. To remain within the scope of this paper, it can be assumed the Stereo FM station broadcasting the SCA channel does not transmit any intermodulation.

The Nature Of SCA Interference

Studies have shown SCA interference is caused by the forming of intermodulation groups between the modulated SCA channel and the 19 KC PILOT subcarrier and its harmonics. As an aid in explaining how SCA intermodulation becomes audio interference in the stereo receiver, the 67 KC SCA subcarrier can be visualized as being deviated ± 6 KC by a low frequency modulation so that any instantaneous frequency (S) of the frequency modulated SCA channel will lie somewhere between 61 KC and 73 KC. If the 19 KC PILOT of

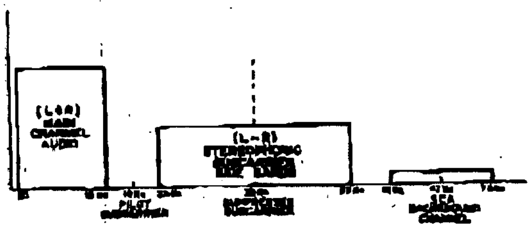

Figure 1—FM Spectrum Containing Stereo Composite Modulation.

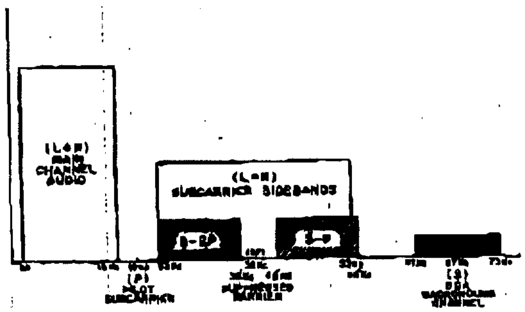

Figure 2—FM Stereophonic Frequency Spectrum With SCA Intermodulation Products.

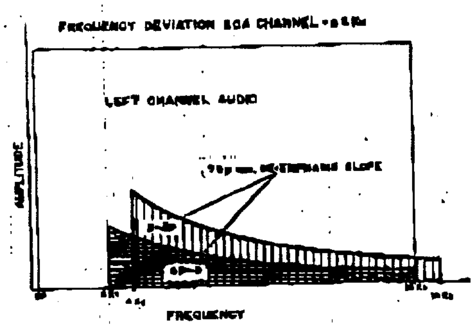

Figure 3—Spectrum of Detected Left Channel Audio Showing Range of SCA Interference.

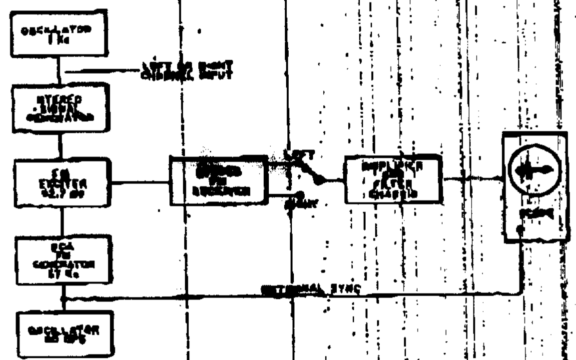

Figure 4—Equipment Diagram for Measuring SCA Interference.

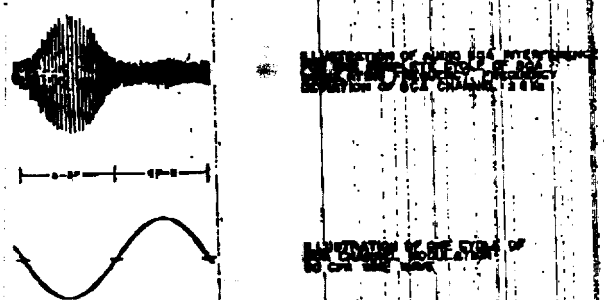

Figure 5

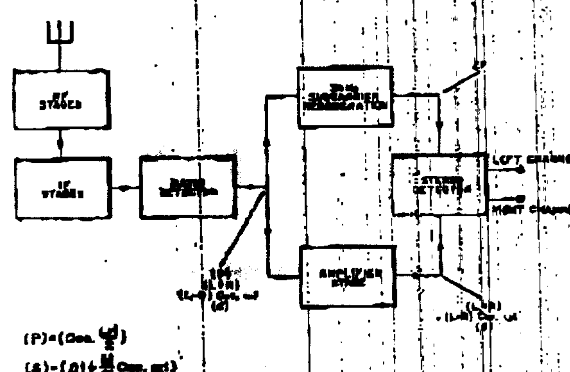

Figure 6—Simplified Block Diagram Ideal Stereo FM Receiver.

the stereo composite signal is designated as (P), the most prominent intermodulation groups formed in a stereo receiver can be identified as (S-P) and (S-2P). These intermodulation product groups fall in the frequency spectrum of the 38 KC SUBCARRIER sidebands as shown in Figure 2. If these product groups are allowed to have access to the 38 KC stereo detector in a receiver, direct amplitude demodulation at (2P) takes place which produces the audio SCA interference.

Analytically, this can be seen if we multiply a demodulation function with a single channel modulated stereo signal which contains SCA intermodulation groups; thereby simulating stereo detector action. The single channel stereo modulation (in this example, left channel is used) with SCA intermodulation groups added can be expressed by:

$$(2)\quad H = L + L\cos\omega t + K_1\cos\left[B(t) - \frac{\omega t}{2}\right] + \ldots K_2\cos\left[B(t) - \omega t\right]$$

where: K_1 and K_2 are intermodulation constants

If the demodulating function $(1+2\cos\omega t)$ is used as the multiplier, the detected product becomes:

$$(3)\quad N = L + L\cos\omega t + 2L\cos\omega t + 2L\cos^2\omega t + \ldots K_1\cos\left[B(t) - \frac{\omega t}{2}\right] + K_1\cos\left[B(t) + \frac{\omega t}{2}\right] + \ldots K_1\cos\left[B(t) - \frac{3\omega t}{2}\right] + K_2\cos\left[B(t) - \omega t\right] + \ldots K_2\cos B(t) + K_2\cos\left[B(t) - 2\omega t\right]$$

Simplifying and eliminating all frequencies above audio, the detected output will be:

$$(4)\quad N = 2L + K_1\cos\left[B(t) - \frac{3\omega t}{2}\right] - K_2\cos\left[2\omega t - B(t)\right]$$

Identical audio SCA interference will result in the right channel as a product of the demodulating function $(1-2\cos\omega t)$ used there.

Inspection of these terms reveal several properties of SCA interference:

1. It is independent of amplitude level and modulation of the stereo channels.

2. It is the result of both second and third order intermodulation; therefore, two audio interference components are present simultaneously.

3. It is dependent on the modulation of the SCA channel for its character.

4. It is dependent on the frequency deviation of the SCA channel for its audio range.

5. The amplitude of SCA interference tends to a de-emphasis curve which is illustrated in Figure 3.

Figure 4 is an equipment diagram for measuring SCA interference in Stereo FM Receivers. It was necessary to insert an AMPLIFIER AND FILTER CHASSIS between the outputs of the receiver and the oscilloscope to obtain a measurable voltage waveform. The AMPLIFIER AND FILTER CHASSIS contain the following:

1. Audio pentode amplifier
2. 15 KC low pass filter
3. 60 CPS hum rejection filter
4. Switchable 50 DB attenuation pad

Interference waveforms for high frequency modulation of the SCA Channel are not very revealing. If a low frequency sine wave is used to modulate the SCA Channel and the oscilloscope is synchronized with this low frequency as in Figure 4, a waveform can be obtained which illustrates the unique character of SCA interference. The top waveform in Figure 5 is such an illustration and is the resulting audio SCA interference for one complete cycle of SCA modulating frequency. In this example, the modulating frequency is 80 CPS; one cycle of which is illustrated in the bottom waveform of Figure 5. As can be seen, there are two components of SCA interference containing varying audio frequencies with 75 μsec de-emphasis amplitude characteristics.

Sources Of SCA Interference

Since the audio SCA interference is caused by the intermodulation groups (S-P) and (S-2P), the principal sources of the interference can be traced to those circuits producing these intermodulation signals. Figure 6 is a simplified block diagram of an ideal stereo receiver showing circuit locations of desired signals. By contrast, Figure 7 is an identical block diagram showing circuit locations of signals, both desired and undesired, which might be found in an actual stereo receiver.

Perhaps the source of SCA intermodulation most overlooked are those circuits which are located prior to the multiplex circuits. These circuits, between the RF STAGES to the RATIO

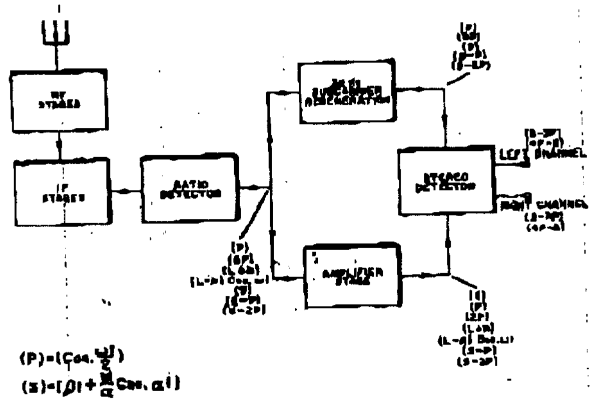

Figure 7—Simplified Block Diagram Actual Stereo FM Receiver.

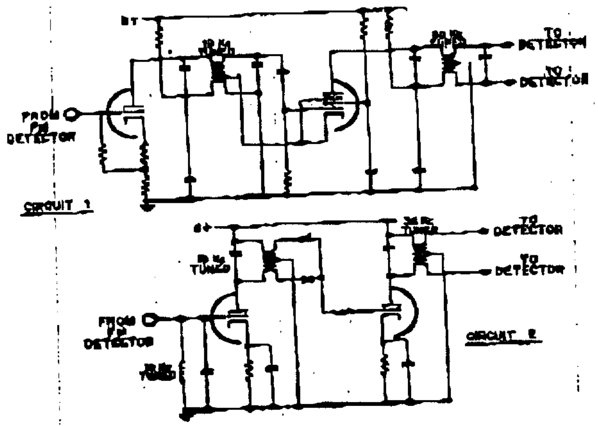

Figure 8—38 Kc Subcarrier Regeneration Techniques.

TEST RECEIVER	TYPE	SCA INTERMODULATION AT FREQUENCY DISCRIMINATOR (Reference 1 Kc (L+R) Signal)		SCA INTERFERENCE AT RECEIVER OUTPUT (Reference 100% Desired Channel)		SCA FILTER (NO. USED)	STEREO CHANNEL SEPARATION
		[illegible]	[illegible]	[illegible]	[illegible]		
1	Large Console	−41 db	−47 db	−[illegible] db	−[illegible] db	1	[illegible] db
2	Large Console	−36 db	—	−30 db	−[illegible] db	2	35 db
3	Table Model	−[illegible] db	—	−[illegible] db	−[illegible] db	2	32 db
4	Small Console	−[illegible] db	−[illegible] db	−35 db	−40 db	1	30 db
5	[illegible] Console	−41 db	—	−44 db	−50 db	1	10 db
6	Small Console	−34 db	—	−43 db	−50 db	1	25 db
7	Component Tuner	−42 db	−41 db	−53 db	−56 db	1	35 db

Figure 9—Results of SCA Interference Test.

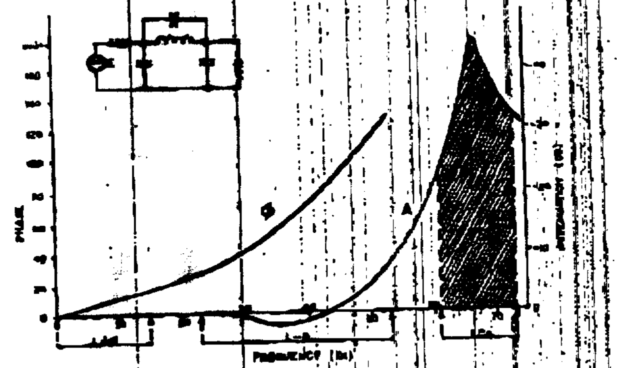

Figure 10—Amplitude and Phase Response of a Typical SCA Rejection Filter.

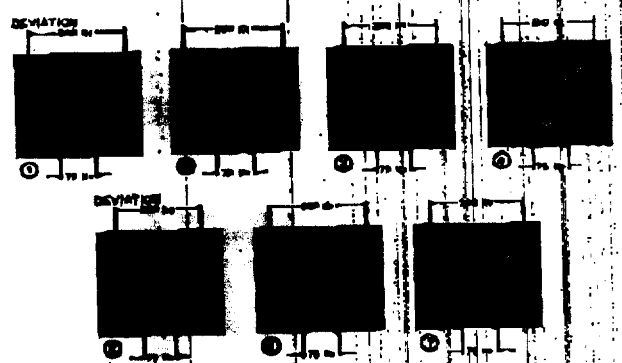

Figure 11—Amplitude Characteristics—IF Stages of Test Receivers.

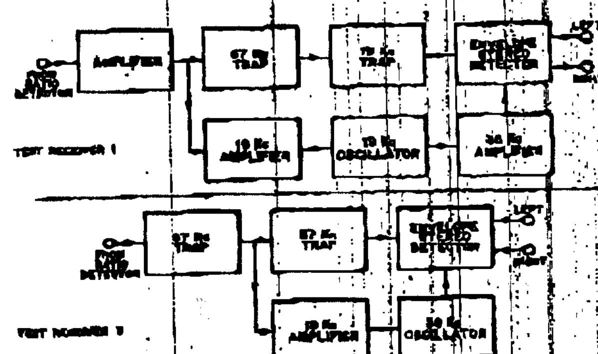

Figure 12—Multiplex Circuit Block Diagrams of Two Test Receivers.

DETECTOR, can assert non-linear properties on the desired composite signal and produce amounts of intermodulation varying with the quality and alignment of these stages. Since the instantaneous frequency of the SCA intermodulation groups will lie between 23 KC and 54 KC as shown in Figure 2, this intermodulation has direct access to the stereo detector.

As can be seen in Figure 7, another possible source of SCA intermodulation are the 38 KC REGENERATION STAGES where the 19 KC is amplified, doubled in frequency, and injected at a high level into the STEREO DETECTOR. The susceptibility of these stages to SCA intermodulation is partly due to the high amplification found in these circuits. Also, any (S-P) and (S-2P) intermodulation formed in these stages may not be effectively filtered out by the final 38 KC selective stage. Of the many actual design approaches used in production receivers, only two techniques will be discussed from the SCA interference point of view.

One technique commonly used is called the locked oscillator approach. A 19 KC oscillator becomes phase-locked with the 19 KC PILOT present at the receiver ratio detector. This output is doubled by means of a tuned circuit at 38 KC which is then amplified to drive the detector. An example of a circuit of this type is presented in Circuit 1 of Figure 8. This approach can be rich in 19 KC harmonic content; therefore, should there be any SCA channel modulation present in these stages, (S-P) and (S-2P) will be generated. Just as important, these harmonics of 19 KC can later cause direct intermodulation in the STEREO DETECTOR. This source is not restricted to 19 KC locked oscillator circuits alone but is typical of many tuned amplifier approaches used.

For comparison, another method which can be used for regeneration of the 38 KC SUBCARRIER is the type used in Circuit 2 of Figure 8. In this approach, the 19 KC PILOT present at the ratio detector is filtered, amplified, and by means of two diodes, doubled into a full wave rectified function. This signal is then amplified and filtered again at 38 KC before insertion into the demodulator. The grid resistor of the second triode in Circuit 2 can also provide clipping of the full-wave rectified function which further reduces the possibility of unwanted harmonics of 19 KC riding through. The over-all advantage of this approach to subcarrier regeneration is that only harmonics of 38 KC are present in the subcarrier; thus only (S-2P) SCA intermodulation will be of any consequence.

The AMPLIFIER STAGE shown in Figures 6 and 7 may or may not be necessary depending on the particular design of the stereo multiplex circuits. Should such an amplifier be necessary, linear phase response and broad-band frequency response are mandatory to both minimize the SCA intermodulation and maximize the efficiency of the STEREO DETECTOR.

Another source of SCA interference is the STEREO DETECTOR itself. It should first be mentioned that any (S-P) and (S-2P) intermodulation present at the detector will result in SCA audio interference. If the modulated SCA Channel (S) is present, the non-linear action of the STEREO DETECTOR can directly produce SCA interference in certain detector circuits. For example, if an "average" detector is used with an ideal switching waveform having a 50 per cent duty cycle, the harmonic content of this waveform will be 2P, 6P, 10P, etc.... by Fourier Series. Any intermodulation formed with the SCA Channel (S) will not produce audio SCA interference. Should the duty cycle of the switching waveform not be 50 per cent however, the harmonic content will be 2P, 4P, 6P, etc... and intermodulation with (S) will produce audio SCA interference (4P-S). This same phenomena occurs when an envelope detector is used, since in an envelope detector, the diodes conduct for a short period of time only.

The STEREO DETECTOR can also become a source of SCA interference should the CARRIER REGENERATION STAGES not provide an ideal switching waveform, but one which is rich in harmonics of the 19 KC PILOT. The third and fourth harmonic of 19 KC will beat with the SCA Channel present and directly form (S-3P) and (4P-S) interference.

Testing Of A Cross-Section Of The Stereo FM Receiver Market

The question must properly arise as to what level of SCA interference could be called objectionable interference. Qualitative listening tests were conducted in a quiet room using a high RF signal strength. It was concluded that the SCA interference level of -60 DB could be considered negligible to a critical listener. It was further thought that an SCA interference level of -55 DB would be unnoticeable to the average listener.

To determine what level of SCA audio interference might be found in a stereo FM receiver purchased today, a group of receivers which could be considered a cross-section of the stereo FM receiver market were acquired and measured as they came from the manufacturer using the test set-up of Figure 4. During measurements, all receivers were center-tuned on station thereby providing maximum reference signal and minimum SCA interference. The function below was used as reference for the levels of SCA interference measured at receiver output.

$$\text{Level of SCA interference} = 20 \log_{10} \frac{\text{Maximum amplitude of interference}}{\text{Amplitude of desired 1 KC audio}}$$

Results of these measurements are seen in Figure 9. All of the test receivers contained at least one SCA rejection filter. SCA interference seems to be a serious problem in at least three of the receivers tested. Although none of the receivers achieved a measured SCA interference of -60 db, some receivers could have attained this level with greater care in alignment.

Minimizing SCA Interference

It would be impossible to discuss methods necessary to minimize SCA interference in all Stereo FM Receivers, however, the following four considerations might suffice:

1. Quality of SCA Filter

2. Location of SCA Filter

3. Regeneration of clean 38 KC switching voltage

4. Reduction of intermodulation in tuner portion of receiver.

1. Perhaps the most commonly used method of reducing SCA interference has been the insertion of simple 67 KC rejection filters somewhere in the multiplex circuits. Design specifications for an ideal SCA filter are rather rigid. Such a filter should provide a flat passband and linear phase response up to 53 KC for maximum efficiency of the STEREO DETECTOR. It must provide infinite attenuation from 61 KC to 73 KC for suppression of the SCA Channel. Complex filters, such as the Bode or Butterworth configurations, can be made which would approximate these specifications, however, neither their physical size or cost make their use practical in production receivers. Figure 10 is an example of a simple one coil rejection filter which serves well as a compromise. This simple filter cannot provide good attenuation over the entire SCA frequency spectrum, however it can be adequate for some receivers having other multiplex circuit design features. Circuit designers apparently have ignored the two section filter because of its increased phase non-linearity and higher cost. On the other hand, some designers have used two single coil traps at different multiplex circuit locations with good effect.

2. The actual circuit location of the SCA filter is as important as the amplitude attenuation characteristic. Unfortunately multiplex circuit designers have frequently placed the SCA filter directly at the input to the STEREO DETECTOR ignoring the 38 KC SUBCARRIER REGENERATION stages as a source of intermodulation. In experiments on a particular model of receiver, it was found that SCA audio interference could be reduced 6 to 10 DB simply by placing the input to the SUBCARRIER REGENERATION stages after the SCA filter.

3. The importance of regenerating a clean 38 KC switching voltage cannot be over-emphasized. Some multiplex circuit designers have overlooked this in their rush to provide stereo indicator lights and automatic monaural-to-stereo mode switching. The addition of a highly selective 38 KC stage would improve the harmonic output of many subcarrier regeneration circuits used in receivers.

4. As can be seen from Figure 9, SCA intermodulation is formed in the tuner portion of production receivers in varying quantities. The (S-P) intermodulation seems to be predominant. Two approaches can be used to minimize interference caused by this intermodulation.

Since all the necessary stereo information is carried by either sideband of the (L-R) suppressed subcarrier channel, vestigial sideband detection utilizing the lower sideband could be used in the multiplex circuits. This approach would necessitate attenuation of the upper sideband or, in effect, attenuation of the (S-P) intermodulation. The major disadvantage of this approach is the resulting 6 DB loss in recovered stereo output which is undesirable in production receivers.

A more logical approach would be to determine the apparent cause of this intermodulation and minimize it. Perhaps, the prime suspect for intermodulation in the tuner portion of receivers would be a non-linear phase response in the IF STAGES. Many production alignment procedures for these stages stress maximum amplitude characteristics for maximum receiver sensitivity rather than symmetrical amplitude characteristics for most linear phase response. A visual inspection of the amplitude characteristics of the IF STAGES of the Test Receivers supports this conclusion as can be seen in Figure 11. Test Receivers 2 and 3, which exhibited the least amount of SCA intermodulation, both possess symmetrical amplitude characteristics in the IF STAGES. Test Receivers 1, 4, 5, 6, and 7 possess varying asymmetrical IF amplitude characteristics and it can be seen from Figure 9, they exhibit substantially more SCA intermodulation than the other two. Test Receivers 1 and 4 appear to have basic design deficiencies. The intermodulation found in Test Receivers 5, 6, and 7 could have been substantially reduced by symmetrical alignment of the IF STAGES. Perhaps it is time for re-evaluation of tuner alignment procedures on the part of some manufacturers.

Figure 12 serves as a comparison illustrating some of the methods emphasized in this section. Both Test Receivers compared used envelope detection and both included one or more SCA filters in the multiplex circuits. The SCA interference level of -48 DB for Test Receiver 3 could be considered marginal since the receiver is a table model with reduced high frequency response. This particular approach used two simple 67 KC traps quite effectively with an envelope detector. The SCA interference level of -30 DB for Test Receiver 1 does not speak well of the large console that came with it. Test Receiver 1 has probable serious intermodulation sources in the IF STAGES, SUB-CARRIER REGENERATION STAGES, and consequently, the ENVELOPE DETECTOR. A significant improvement could be achieved if the IF amplitude response were improved and the 67 KC trap relocated in front of the 19 KC amplifier stage.

Conclusions

Since, potentially all of the FM Stereo Stations could elect to broadcast an SCA channel, it is necessary for receiver manufacturers to take SCA interference into consideration for quality Stereo FM receiver design. It can be concluded that some manufacturers have minimized SCA interference in their production receivers so that it could be considered negligible to the average listener. Other manufacturers have not.

There are other factors not included in this evaluation which influence SCA interference found in production receivers:

1. If a particular receiver is producing excessive SCA interference, the consumer will tend to blame the FM broadcast station rather than the receiver manufacturer. It is conceivable that some such manufacturers do not realize SCA interference is a problem in their receivers.

2. Within present FCC specifications, stereo FM broadcast stations can, and some do, use a frequency deviation of $\pm$ 8 KC for the SCA channel.

MM 99-25

ORIGINAL

RECEIVED

MAR 06 2000

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

EX PARTE OR LATE FILED

The Honorable William E. Kennard
Chairman,
Federal Communications Commission
The Portals
455 Twelfth Street S.W.
Washington, D.C. 20554

Dear Chairman Kennard,

I substantially agree with the statements in the following form letter provided by the author of LPFM petition RM-9242, Mr. Roger Skinner:

I am a supporter of creation of a Low Power FM (LPFM) radio service as outlined in the FCC's Notice of Proposed Rulemaking in docket MM 99-25, which called for creation of 1000 watt and 100 watt commercial and non-commercial LPFM stations nationwide.

It has come to my attention that the FCC intends to vote at its Jan 20th meeting to severely gut this proposal (NPRM) providing for only non-commercial stations with maximum power of 100 watts (coverage thus limited to only 3.5 miles as opposed to 9 miles for a 1000 watt station).

To place such severe limits on LPFM would doom the service before it begins, making it impossible to obtain enough financial suport, without being able to sell commercial airtime, to exist.

What possible reason can the FCC give for not permitting commercially suported LPFM stations, other than to protect NAB member stations from competition? Commercial support has nothing to do with interference! There is no good reason to doom the LPFM service by taking away its ability to support itself by the sale of commercial advertising, a method of support that has served this nation's stations well for over 75 years!

In fact, to not allow commercial support would do a great dis-service to small businesses in America that cannot afford to advertise on full-power radio stations. Their needs would have been met by LPFM stations. A decision to not allow commercial support would have a vast negative impact on small business in America and may well violate some rules of the Small Business Administration.

I wish to remind you that there was an overwhelming number (thousands) of comments filed in this proceeding supporting the creation of 1000 watt and 100 watt stations, allowing for both commercial and non-commercial operation as set forth in the FCC's NPRM.

The public has spoken on this matter and to ignore this public mandate and cave in to political pressure from the National Association of Broadcasters (NAB) is a disgrace, and use of such anti-competitive actions by the NAB should be investigated by the Justice Department.

No. of Copies rec'd 2
List ABCDE

The NAB tried to cause confusion on this issue by claiming that the new LPFM stations would cause interference to existing stations. A receiver study conducted by the FCC proved this to be incorrect. The NAB raised this smokescreen issue to attempt to conceal its real dislike for LPFM, the fact that it does not want competition for listeners or advertising revenues for its member stations. The FCC cannot prevent competition and is supposed to promote competition.

I would hope that the FCC would vote for LPFM in its full form as proposed in the NPRM or delay the vote to clear the way for a workable LPFM service of 1000 watt and 100 watt commercial and non-commercial stations.

Respectfully,

Gary Patzel
1834 N. Circle Drive
Colorado Springs, CO 80909-2411
Phone: 719-634-8060

ORIGINAL

MM 9 RECEIVED

EX PARTE OR LATE FILED

MAR 06 2000

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Dear Chairman Kennard,

I am a supporter of creation of a Low Power FM (LPFM) radio service as outlined in the FCC's Notice of Proposed Rulemaking in docket MM 99-25, which called for creation of 1000 watt and 100 watt commercial and non-commercial LPFM stations nationwide.
It has come to my attention that the FCC intends to vote at its Jan 20th meeting to severely gut this proposal (NPRM) providing for only non-commercial stations with maximum power of 100 watts (coverage thus limited to only 3.5 miles as opposed to 9 miles for a 1000 watt station).

To place such severe limits on LPFM would doom the service before it begins, making it impossible to obtain enough financial support, without being able to sell commercial airtime, to exist

What possible reason can the FCC give for not permitting commercially supported LPFM stations, other than to protect NAB member stations from competition? Commercial support has nothing to do with interference! There is no good reason to doom the LPFM service by taking away its ability to support itself by the sale of commercial advertising, a method of support that has served this nation's stations well for over 75 years!
In fact to not allow commercial support would do a great disservice to small businesses in America that cannot afford to advertise on full-power radio stations. LPFM stations would have met their needs. A decision to not allow commercial support would have a vast negative impact on small business in America and may well violate some rules of the Small Business Administration.

I wish to remind you that there was an overwhelming number (thousands) of comments filed in this proceeding supporting the creation of 1000 watt and 100 watt stations, allowing for both commercial and non-commercial operation as set forth in the FCC's NPRM.
The public has spoken on this matter and to ignore this public mandate and cave in to political pressure from the National Association of Broadcasters (NAB) is a disgrace and use of such anti-competitive actions by the NAB should be investigated by the Justice Department.

The NAB tried to cause confusion on this issue by claiming that the new LPFM stations would cause interference to existing stations. A receiver study conducted by the FCC proved this to be incorrect. The NAB raised this smokescreen issue to attempt to conceal its real dislike for LPFM, the fact that it does not want competition for listeners or advertising revenues for its member stations. The FCC cannot prevent competition and is supposed to promote competition.

I would hope that the FCC would vote for LPFM in its full form as proposed in the NPRM or delay the vote to clear the way for a workable LPFM service of 1000 watt and 100 watt commercial and non-commercial stations.

Respectfully,

Alan Heinze
PO Box 62433, Boulder City, NV 89006
702-294-3057

No. of Copies rec'd 2
List ABCDE

MM 99-25

ORIGINAL

RECEIVED

MAR 06 2000

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Fax cover sheet

Page 1 of 13

EX PARTE OR LATE FILED

To: The Honorable William Kennard
Chairman, Federal Communications Commission
Fr: Mac England, for 12 citizens in Flagstaff

Note:

Chairman Kennard,

I know you are quite busy these days, but please take a moment to note the concerns of citizens in Flagstaff, Arizona regarding low-power FM. The accompanying pages came in too late for me to mail so I am fazing them now (I know there are others following as well) and will mail the hard copies first class tomorrow so you have original documentation.

Have a great day!

Mac England
Mountain Air Community Radio
13 N. San Francisco Street, #101
Flagstaff, Az. 86001

520-214-9679
macr@infomagic.com

No. of Copies rec'd 2
List ABCDE

ORIGINAL MM 99-25

RECEIVED

MAR 06 2000

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

ATTN: Mr. William E. Kennard, Chairman
Federal Communications Commision
Fax: (202) 418-2801

Dear Mr. Kennard:

I am a supporter of creation of a Low Power FM (LPFM) radio service as outlined in the FCC's Notice of Proposed Rulemaking in docket MM 99-25, which called for creation of 1000 watt and 100 watt commercial and non-commercial LPFM stations nationwide.

It has come to my attention that the FCC intends to vote at its Jan 20th meeting to severely gut this proposal (NPRM) providing for only non-commercial stations with maximum power of 100 watts (coverage thus limited to only 3.5 miles as opposed to 9 miles for a 1000 watt station).

To place such severe limits on LPFM would doom the service before it begins, making it impossible to obtain enough financial support, without being able to sell commercial airtime, to exist.

What possible reason can the FCC give for not permitting commercially supported LPFM stations, other than to protect NAB member stations from competition? Commercial support has nothing to do with interference! There is no good reason to doom the LPFM service by taking away its ability to support itself by the sale of commercial advertising, a method of support that has served this nation's stations well for over 75 years!

In fact to not allow commercial support would do a great dis-service to small businesses in America that cannot afford to advertise on full-power radio stations. Their needs would have been met by LPFM stations. A decision to not allow commercial support would have a vast negative impact on small business in America and may well violate some rules of the Small Business Administration.

I wish to remind you that there was an overwhelming number (thousands) of comments filed in this proceeding supporting the creation of 1000 watt and 100 watt stations, allowing for both commercial and non-commercial operation as set forth in the FCC's NPRM.

The public has spoken on this matter and to ignore this public mandate and cave in to political pressure from the National Association of Broadcasters (NAB) is a disgrace and and use of such anti-competitive actions by the NAB should be investigated by the Justice Department.

The NAB tried to cause confusion on this issue by claiming that the new LPFM stations would cause interference to existing stations. A receiver study conducted by the FCC proved this to be incorrect. For example, in Manitou Springs (just

EX PARTE OR LATE FILED

west of Colorado Springs) a low-power "translator" station operates at 89.1 FM, just two channels away from a full power station at 88.7 FM, and neither station experiences any interference. Also, in Cañon City, a full-power station 104.5 FM receives no interference from a local translator at 104.9 FM. The NAB raised this smokescreen issue to attempt to conceal its real dislike for LPFM, the fact that it does not want competition for listeners or advertising revenues for its member stations. The FCC cannot prevent competition and is, in fact, supposed to promote it.

I would hope that the FCC would vote for LPFM in its full form as proposed in the NPRM or delay the vote to clear the way for a workable LPFM service of 1000 watt and 100 watt commercial and non-commercial stations.

Respectfully,

John T. Ravetti
4905 Escapardo Way
Colorado Springs, CO 80917-3721

No. of Copies rec'd 2
List ABCDE

MM 99-25 RECEIVED

MAR 06 2000

ORIGINAL

FAX 202-418-2820

EX PARTE OR LATE FILED FEDERAL COMMUNICATIONS COMMISSION OFFICE OF THE SECRETARY

Dear Commissioner Powell,

I am a supporter of creation of a Low Power FM (LPFM) radio service as outlined in the FCC's Notice of Proposed Rulemaking in docket MM 99-25, which called for creation of 1000 watt and 100 watt commercial and non-commercial LPFM stations nationwide.
It has come to my attention that the FCC intends to vote at its Jan 20th meeting to severely gut this proposal (NPRM) providing for only non-commercial stations with maximum power of 100 watts (coverage thus limited to only 3.5 miles as opposed to 9 miles for a 1000 watt station).

To place such severe limits on LPFM would doom the service before it begins, making it impossible to obtain enough financial support, without being able to sell commercial airtime, to exist.

What possible reason can the FCC give for not permitting commercially supported LPFM stations, other than to protect NAB member stations from competition? Commercial support has nothing to do with interference! There is no good reason to doom the LPFM service by taking away its ability to support itself by the sale of commercial advertising, a method of support that has served this nation's stations well for over 75 years!
In fact to not allow commercial support would do a great disservice to small businesses in America that cannot afford to advertise on full-power radio stations. LPFM stations would have met their needs. A decision to not allow commercial support would have a vast negative impact on small business in America and may well violate some rules of the Small Business Administration.

I wish to remind you that there was an overwhelming number (thousands) of comments filed in this proceeding supporting the creation of 1000 watt and 100 watt stations, allowing for both commercial and non-commercial operation as set forth in the FCC's NPRM.
The public has spoken on this matter and to ignore this public mandate and cave in to political pressure from the National Association of Broadcasters (NAB) is a disgrace and use of such anti-competitive actions by the NAB should be investigated by the Justice Department.

The NAB tried to cause confusion on this issue by claiming that the new LPFM stations would cause interference to existing stations. A receiver study conducted by the FCC proved this to be incorrect. The NAB raised this smokescreen issue to attempt to conceal its real dislike for LPFM, the fact that it does not want competition for listeners or advertising revenues for its member stations. The FCC cannot prevent competition and is supposed to promote competition.

I would hope that the FCC would vote for LPFM in its full form as proposed in the NPRM or delay the vote to clear the way for a workable LPFM service of 1000 watt and 100 watt commercial and non-commercial stations.

Respectfully,

Alan Heinze
PO Box 62433, Boulder City, NV 89006
702-294-3057

No. of Copies rec'd 2
List ABCDE

RECEIVED

ORIGINAL MAR 06 2000 MM 99-25

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

EX PARTE OR LATE FILED

Dear Commissioner Powell:

I am a supporter of creation of a Low Power FM (LPFM) radio service as outlined in the FCC's Notice of Proposed Rulemaking in docket MM 99-25, which called for creation of 1000 watt and 100 watt commercial and non-commercial LPFM stations nationwide.

It has come to my attention that the FCC intends to vote at its Jan 20th meeting to severely gut this proposal (NPRM) providing for only non-commercial stations with maximum power of 100 watts (coverage thus limited to only 3.5 miles as oppossed to 9 miles for a 1000 watt station).

To place such severe limits on LPFM would doom the service before it begins, making it impossible to obtain enough financial support, without being able to sell commercial airtime, to exist.

What possible reason can the FCC give for not permitting commercially supported LPFM stations, other than to protect NAB member stations from competition? Commercial support has nothing to do with interference! There is no good reason to doom the LPFM service by taking away its ability to support itself by the sale of commercial advertising, a method of support that has served this nations stations well for over 75 years!

In fact to not allow commercial support would do a great dis-service to small businesses in America that cannot afford to advertise on full-power radio stations. Their needs would have been met by LPFM stations. A decision to not allow commercial support would have a vast negative impact on small business in America and may well violate some rules of the Small Business Administration.

I wish to remind you that there was an overwhelming number (thousands) of comments filed in this proceeding supporting the creation of 1000 watt and 100 watt stations, allowing for both commercial and non-commercial operation as set forth in the FCC's NPRM.

The public has spoken on this matter and to ignore this public mandate and cave in to political pressure from the National Association of Broadcasters (NAB) is a disgrace and and use of such anti-competitive actions by the NAB should be investigated by the Justice Department.

The NAB tried to cause confusion on this issue by claiming that the new LPFM stations would cause interference to existing stations. A receiver study conducted by the FCC proved this to be incorrect. The NAB raised this smokescreen issue to attempt to conceal its real dislike for LPFM, the fact that it does not want competition for listeners or advertising revenues for its member stations. The FCC cannot prevent competition and is supposed to promote competition.

No. of Copies rec'd ~~0+1~~ 2
List ABCDE

MM 99-25

I would hope that the FCC would vote for LPFM in its full form as proposed in the NPRM or delay the vote to clear the way for a workable LPFM service of 1000 watt and 100 watt commercial and non-commercial stations.

Respectfully,

Paul Billings
2312 Baker St.
PO Box 4553
Muskegon Heights, Michigan 49444

Lets bring Radio back to the people, please support LPFM!

ORIGINAL

MM99-25

RECEIVED

MAR 06 2000

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

EX PARTE OR LATE FILED

Commissioner Michael Powell
Federal Communications Commission
445 12th St. S.W.
Washington DC 20554

Commissioner Powell,

My name is Jay Sherwood, and I'm writing to you today as an advocate for Low Power FM radio. I have been informed that a vote is scheduled for January 20, 2000 on MM Docket 99-25, the proposed rulemaking for low powered radio.

I would like to urge you as both a citizen of our great republic, and as an advocate of LPFM to take whatever actions are necessary to make low powered radio a reality. This letter, along with the thousands of others the FCC has received in favor of legitimizing a low power radio service are testament to this countries dissatisfaction with the heavily consolidated radio structure in place today.

Our countries founders felt that unfettered freedom of speech and freedom of the press were of such colossal importance that they made it the first amendment to our Constitution. This was done to establish justice. This was done to promote the general welfare. This was done to secure the blessings of liberty, and that liberty has been subverted by the private corporations and the special interests in Washington who have used the publics spectrum irresponsibly.

I know that Low Power radio can coexist with the rest of the FM spectrum if it is instituted properly. If the FCC still has any reasonable doubts about the technical feasibility of LPFM, then please consider the possibility of establishing several test regions across the US. There could be no better way of finding out if Low Power Radio can work than if stations were to be set up and monitored in real cities across the US.

In closing I would like to thank you for taking the time to consider my opinions. I look forward to hearing from your office in the near future.

Sincerely,

Jay Sherwood

Jay Sherwood
P.O. Box 5175
Hopkins, MN 55343

Lucifuge@ix.Netcom.Com
Day: 612-404-4703
Eve: 612-546-0237

No. of Copies rec'd 0+1
List ABCDE

Christina M. Wimmer

MM 99-25

◆◆◆

3210 Long Iron Drive
Lawrenceville, GA 30044
◆
Email: cwimmer@gateway.net

ORIGINAL

January 20, 2000

RECEIVED

MAR 06 2000

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

EX PARTE OR LATE FILED

Michael Powell
445 12th Street SW
Washington, DC 20554

Dear Mr. Powell:

I am very disturbed with your recent initiative which will require that 50 percent of non-commercial programming be "educational" and not "primarily devoted to relgious exhortation, proselytizing or statements of personally-held religious views or beliefs."

The FCC should not be allowed to enforce such a blatantly obvious violation of the basic freedoms our country was founded upon. This will affect more than 125 non-commercial broadcasters and more specifically almost disable religious programming altogether, which is so obviously the real focus of your initiative. After all, with so much **other** detrimental programming that uses violence and sex to degregate our society even further, why whould you select the one type of programming which inspires and challenges people to be better human beings? You may not believe in the content yourselves, as is so obvious from your actions, but you certainly cannot deny that this type of programming seldom has anywhere near the negative reprecussions of most programs on the air.

I urge you to review our Constitution and its people's basic freedoms and you will find that you have no place in mandating and/or censoring these types of programming. I am offended by your actions as a citizen, an educator and a Christian, and hope you will rethink your position in this matter as it is so obviously an obtrusive misuse of power.

Christina M. Wimmer

CMW/cmw

No. of Copies rec'd 0+1
List ABCDE

MM 99-25

From: Andy Weiss <aw@jps.net> ORIGINAL
To: K4DOM.K4PO2(PJACKSON)
Date: 1/19/00 2:28PM
Subject: Comments from Commissioner Powell's Homepage

RECEIVED

MAR 06 2000

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

EX PARTE OR LATE FILED

Andy Weiss (aw@jps.net) writes:

Dear Mr. Powell,

We are a large, non-profit, community organization in Lake County, California who whole heartedly support Low Power FM radio.
There is no community radio station in our county of nearly 60,000 people. We applied for a full- power construction permit 20 months ago, but are in competition with three groups from outside our area, and have little hope that we will get a license.
LPFM, and the new regulations that would come with it, would give our county a chance to have a locally supported, locally funded, and locally programed, non-commercial radio station, which we desperately need and want.
Thank you
Andy Weiss
Lake County Community Radio

Server protocol: HTTP/1.0
Remote host: 209.239.207.64
Remote IP address: 209.239.207.64

No. of Copies rec'd 2
List ABCDE

ORIGINAL MM 99-25

From: Bill Smolenske <billsmol@aol.com>
To: K4DOM.K4PO2(PJACKSON)
Date: 1/20/00 5:13PM
Subject: Comments from Commissioner Powell's Homepage

Bill Smolenske (billsmol@aol.com) writes:

EX PARTE OR LATE FILED

Dear Michael,
Thankyou for your support of microradio. It is the right thing to do. It is the American thing to do. By law the airwaves belong to the people of the United States, not large corporations. There are issues to be solved but none as difficult as the powerful NAB. We the people need you. Thankyou, Bill Smolenske

---

Server protocol: HTTP/1.0
Remote host: 24.8.189.23
Remote IP address: 24.8.189.23

RECEIVED

MAR 06 2000

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

No. of Copies rec'd 2
List ABCDE

ORIGINAL

MM 99-25

From: John P. Huie <jphuie@athens.net>
To: K4DOM.K4PO2(PJACKSON)
Date: 1/20/00 7:29PM
Subject: Comments from Commissioner Powell's Homepage

RECEIVED

MAR 06 2000

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

John P. Huie (jphuie@athens.net) writes:

Dear Commissioner Powell:
The ownership limitation placed by the FCC upon the new low-power FM stations are, to me, fair and reasonable. Why then does the Commission not see fit to extend such ownership limitations to Commercial stations?
Here in Athens, GA we have seven commercial radio stations; six are owned by the same company. To me, this flies in the face of any conception of a democratic free press.
Sincerely, John Huie / Athens, GA
Article:
http://flagpole.com/Issues/01.05.00/editorsnotes.html

EX PARTE OR LATE FILED

Server protocol: HTTP/1.1
Remote host: 207.42.201.26
Remote IP address: 207.42.201.26

No. of Copies rec'd 2
List ABCDE